

MPM2D  
Examination  
**June 20, 2012**  
**Length: 3 hours**  
(Exam set for 2 hrs. + 1 hr. flex time)



Name : \_\_\_\_\_

Teacher : \_\_\_\_\_

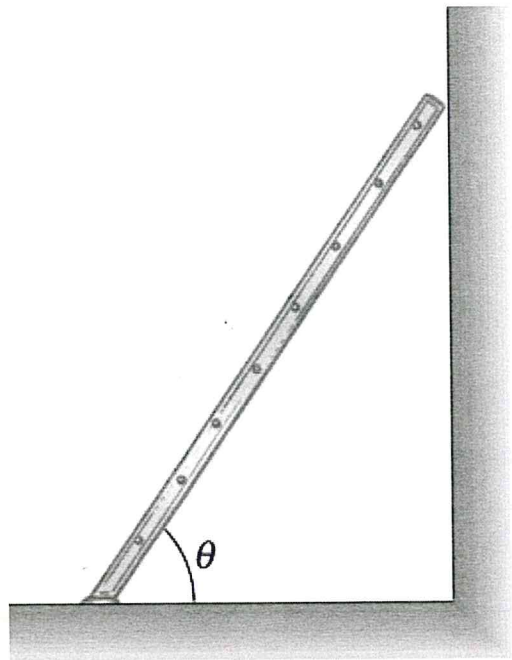
School : \_\_\_\_\_

**Instructions to students:**

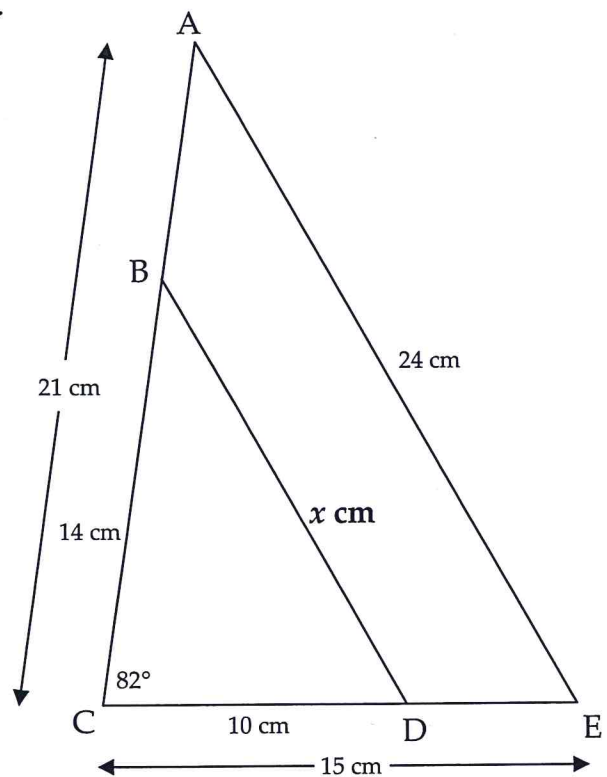
1. This examination booklet is **13 pages** long.  
Please check that you have all the pages.
2. Answer all questions with complete solutions in the spaces provided on the examination paper.
3. You may use any school-approved calculator on this examination.  
Make sure that your calculator is in **DEGREE** mode.  
Do not share your calculator.
4. There is a formula sheet that goes with the examination.
5. Diagrams are not drawn to scale.

## A) Trigonometry

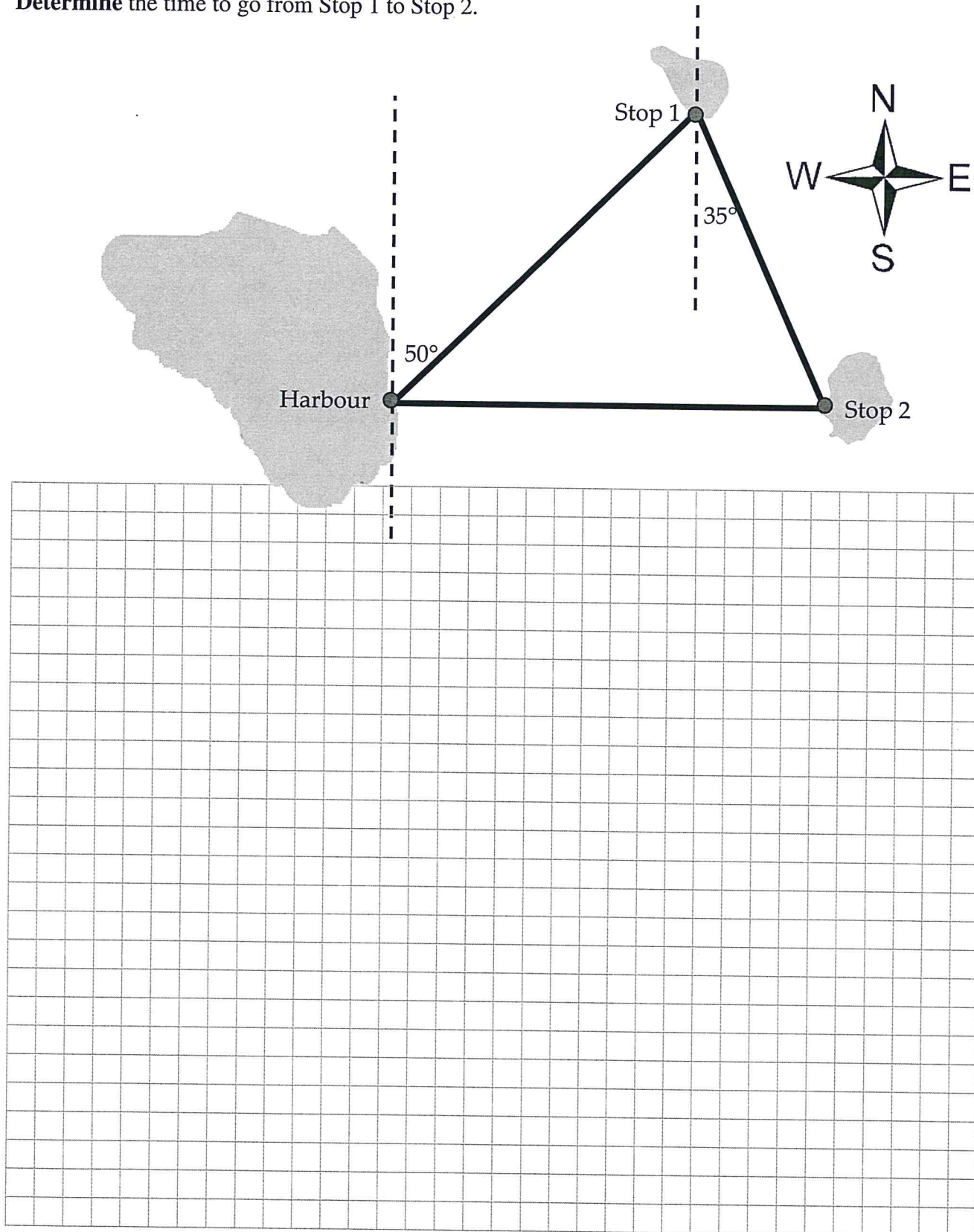
- A1) An 8.0 m long ladder is leaning against a fence. The base of the ladder is 2.0 m from the fence. **Determine** the angle the ladder makes with the ground.



- A2) **Determine** the value of  $x$ . Round to the nearest centimetre. **Verify** your answer using another method.



- A3) A cruise ship, whose path is shown in the diagram below, travels at 25 km/h. It leaves the harbour and travels for two hours before stopping at Stop 1. Later, the ship heads towards Stop 2 which is due east of its starting point. **Determine** the time to go from Stop 1 to Stop 2.

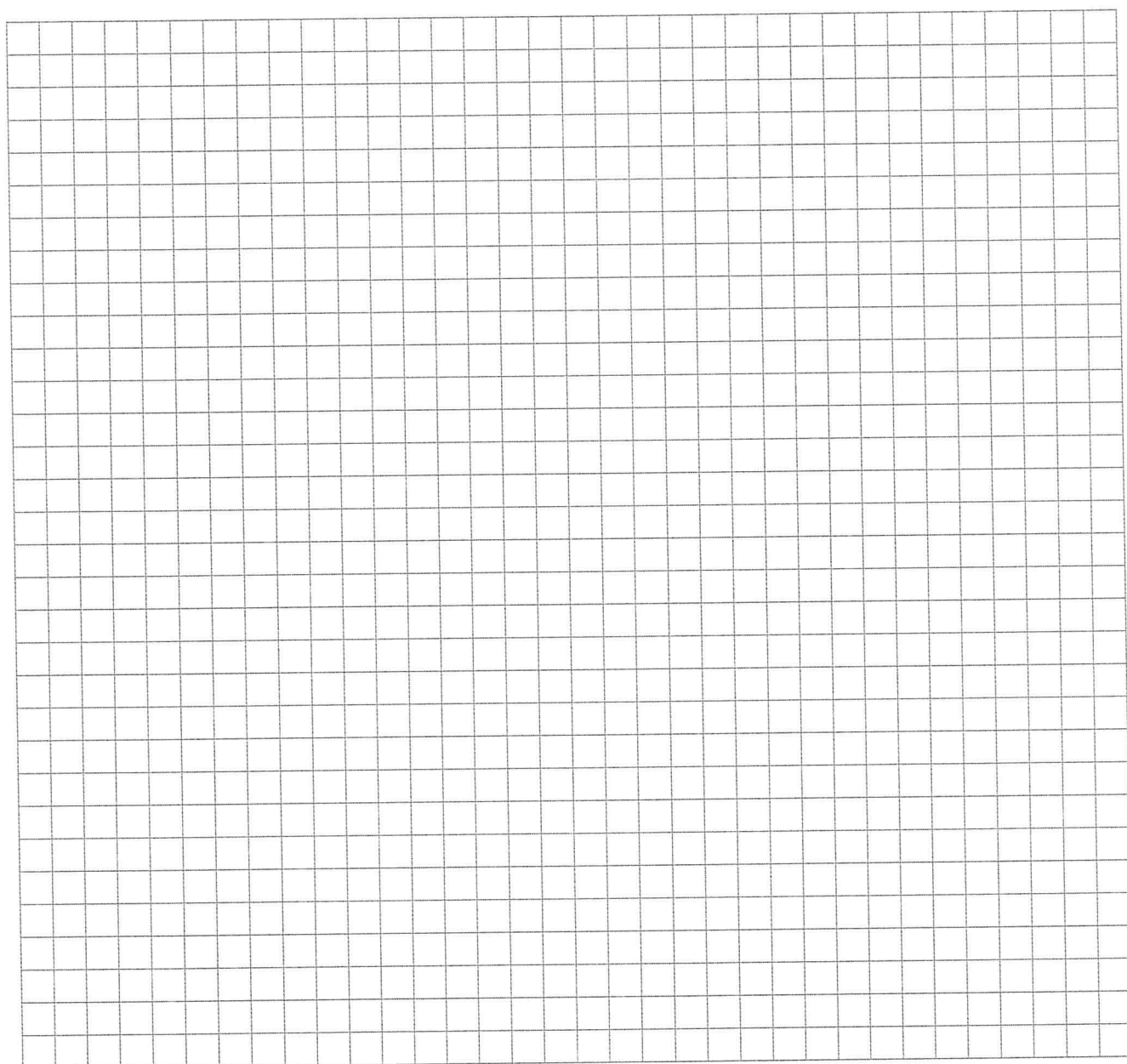
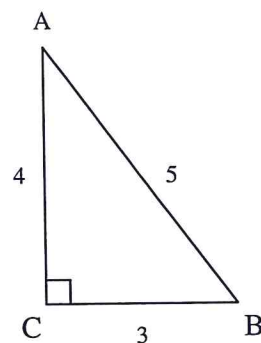


A4) Azra's **tan** key on her calculator is broken .

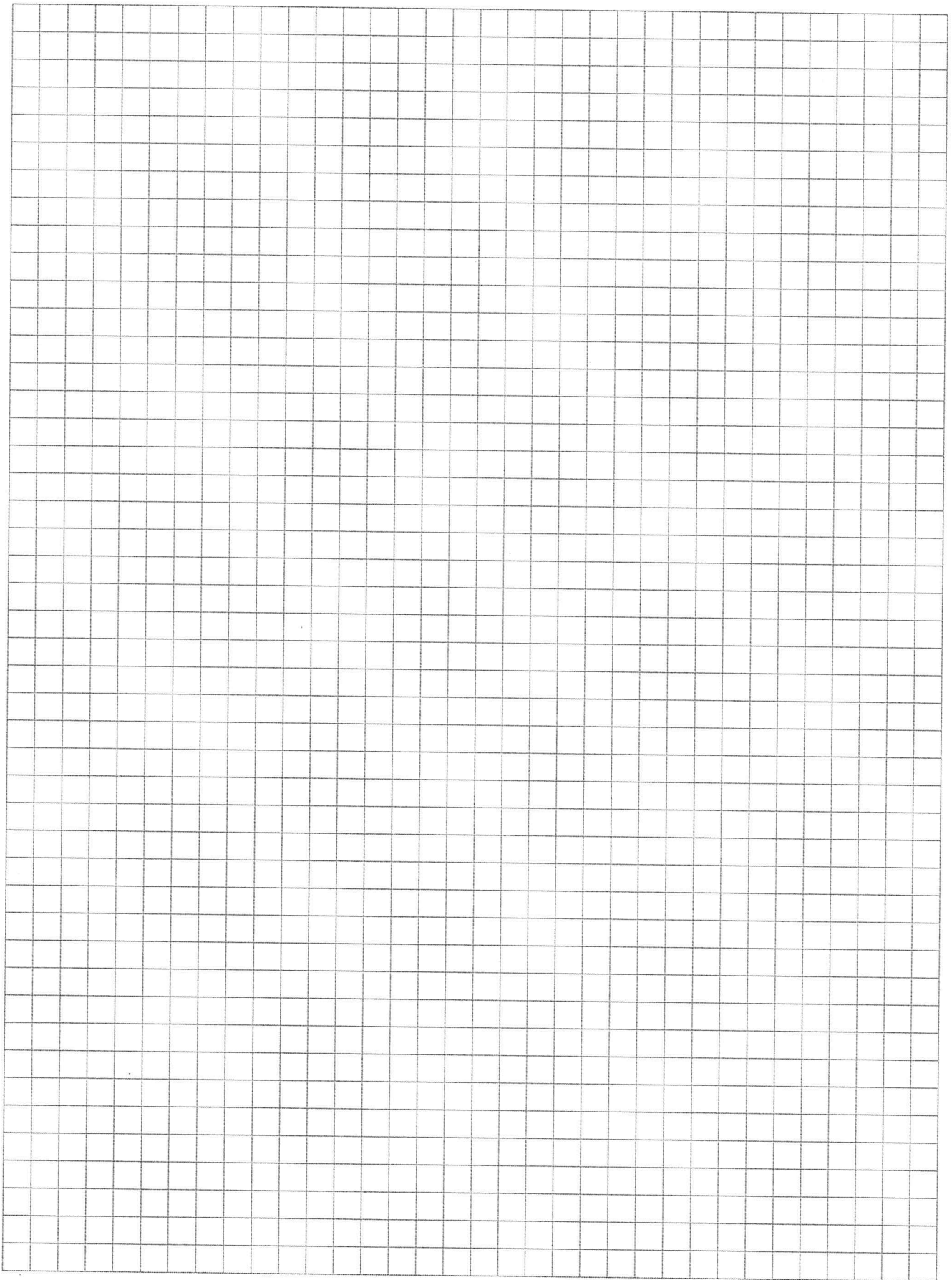
Azra's brother claims that she doesn't need a **tan** key,  
she just needs to calculate  $\sin \theta \div \cos \theta$ .

a) **Verify** that this property works for the triangle below.

b) Do you think it works for all angles? **Justify** your answer.







## B) Analytic Geometry

- B1) Two continuous linear relations are defined below.

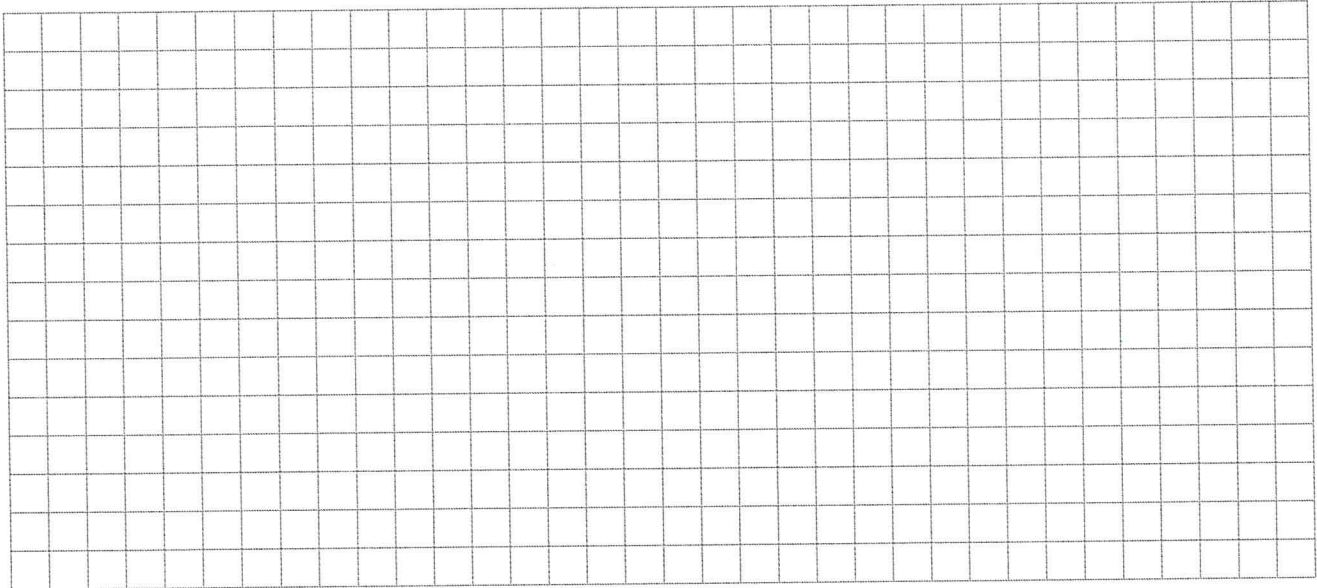
**Determine** the point of intersection of the lines defined by these relations.

**Relation 1:**

$$y = -3x + 12$$

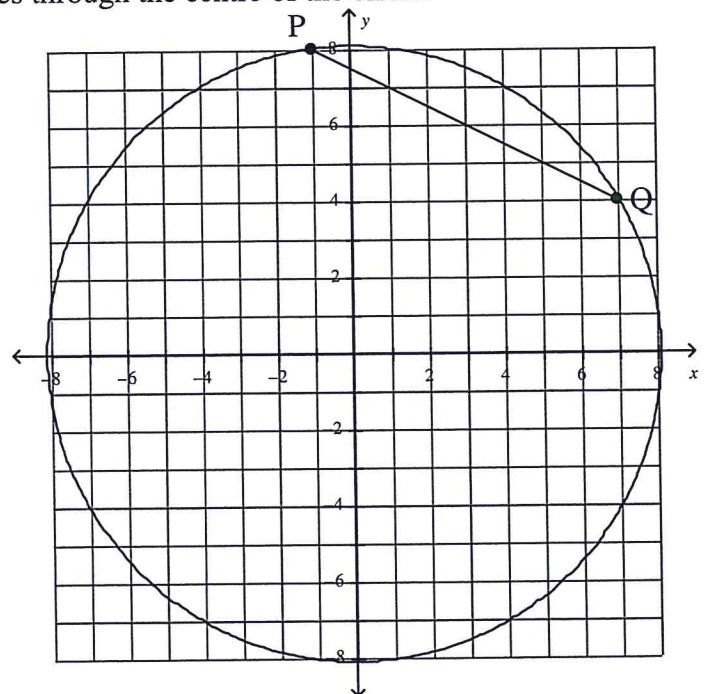
**Relation 2:**

$x$	$y$
-2	-7
-1	-5
0	-3
1	-1



- B2) The points  $P(-1, 8)$  and  $Q(7, 4)$  are on the circle with equation  $x^2 + y^2 = 65$ .

**Verify** that the perpendicular bisector of  $PQ$  passes through the centre of the circle.



- B3)** Jack works at both the Athena Souvlaki Stop and the Bytown Grill. One week he worked for 30 hours at Athena and 10 hours at Bytown and earned \$510. Another week he worked for 20 hours at Athena and 30 hours at Bytown and earned \$690. Jack can only work 23 hours next week.

**Determine the maximum amount of money Jack can earn.**

This image shows a full page of blank graph paper. The grid consists of small, equal-sized squares formed by thin, light gray lines. The grid covers the entire area of the page, leaving no margins or other markings. There are 20 columns and 20 rows of squares, creating a total of 400 square units.



B4) Parallelograms can be created by the line  $y = \frac{4}{3}x$  and three other lines.

a) **Explain** how properties of parallelograms can be used to determine equations of the three other lines.

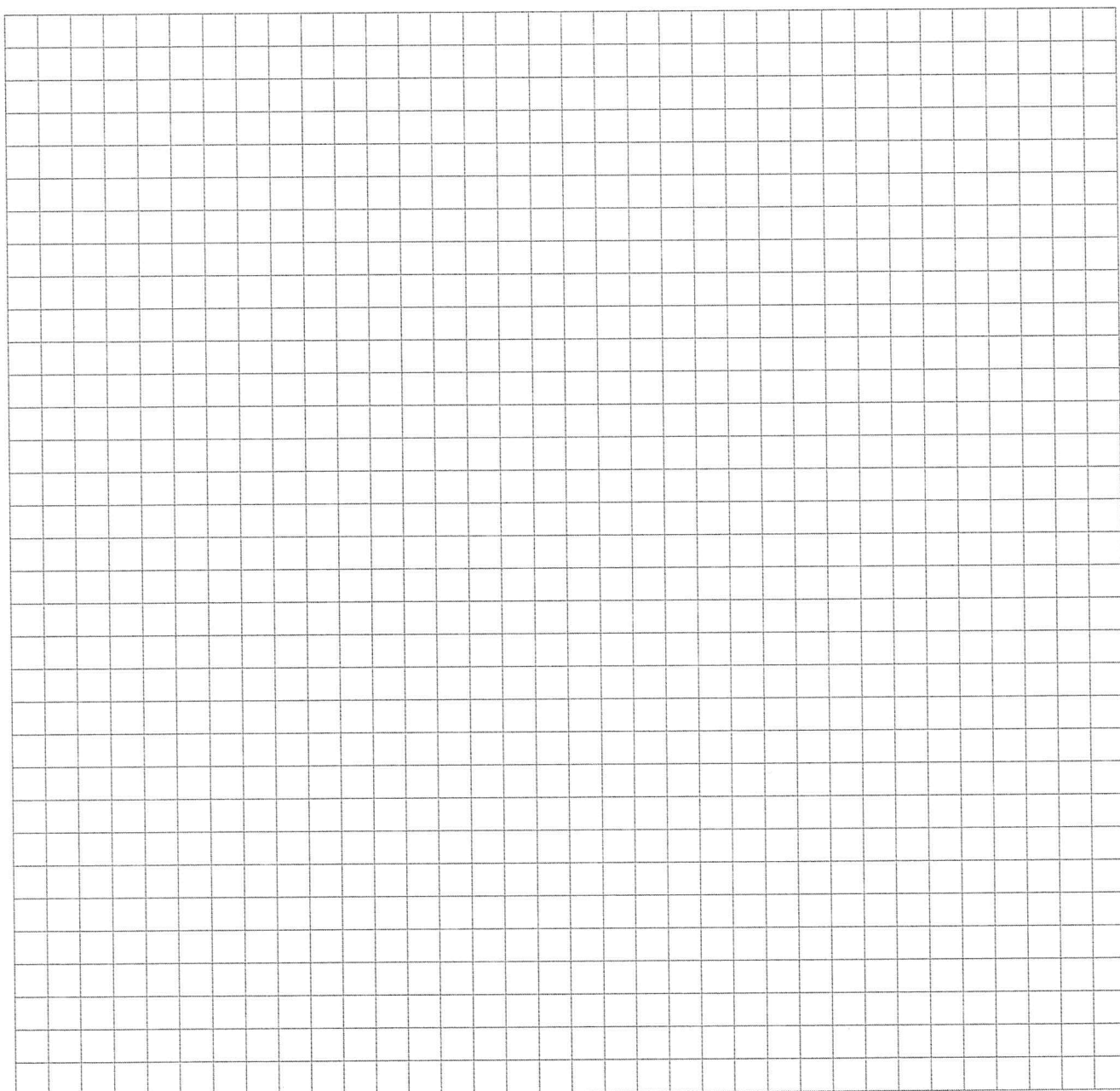
b) Consider a parallelogram with one side contained by  $y = \frac{4}{3}x$ .

The parallelogram has an area of 100 square units.

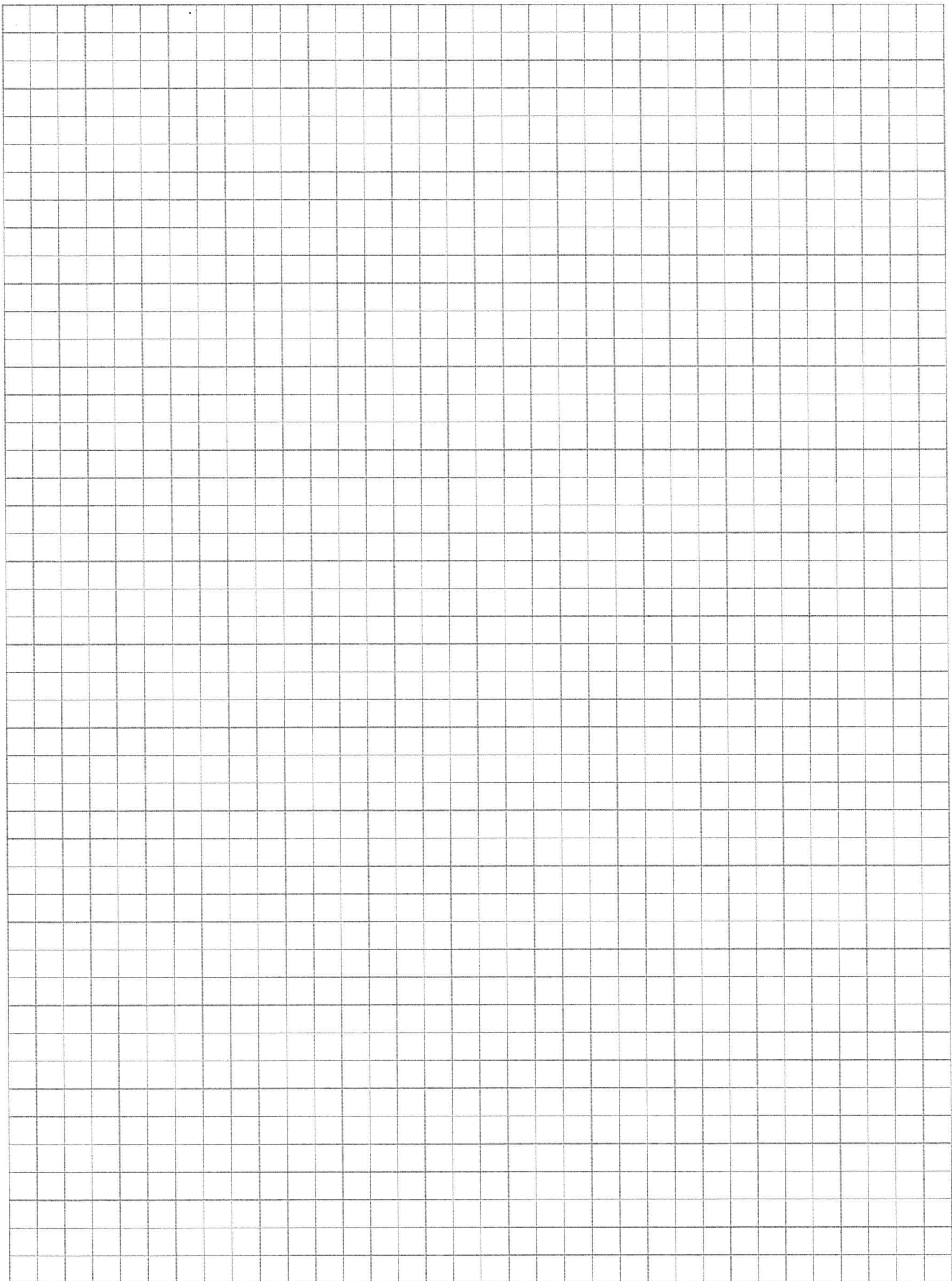
**Determine** one possible set of three equations containing the other sides.

**Justify** your answer.

(Recall: for a parallelogram,  $A = bh$ , where  $A$  is the area,  $b$  is the base and  $h$  is the height.)

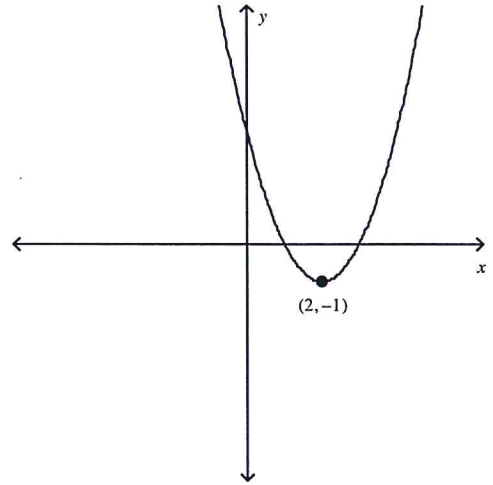






### C) Quadratic Relations

- C1)** The parabola with equation  $y = x^2$  is translated so that its vertex is at  $(2, -1)$ .  
**State** an equation of the new parabola.



- C2)** A rocket is launched from the top of a very tall building.  
The flight of the rocket can be modeled by  $h = -5t^2 + 30t + 80$ , where  $h$  is the height of the rocket in meters relative to ground,  $t$  seconds after being launched.  
**Determine** the maximum height of the rocket.

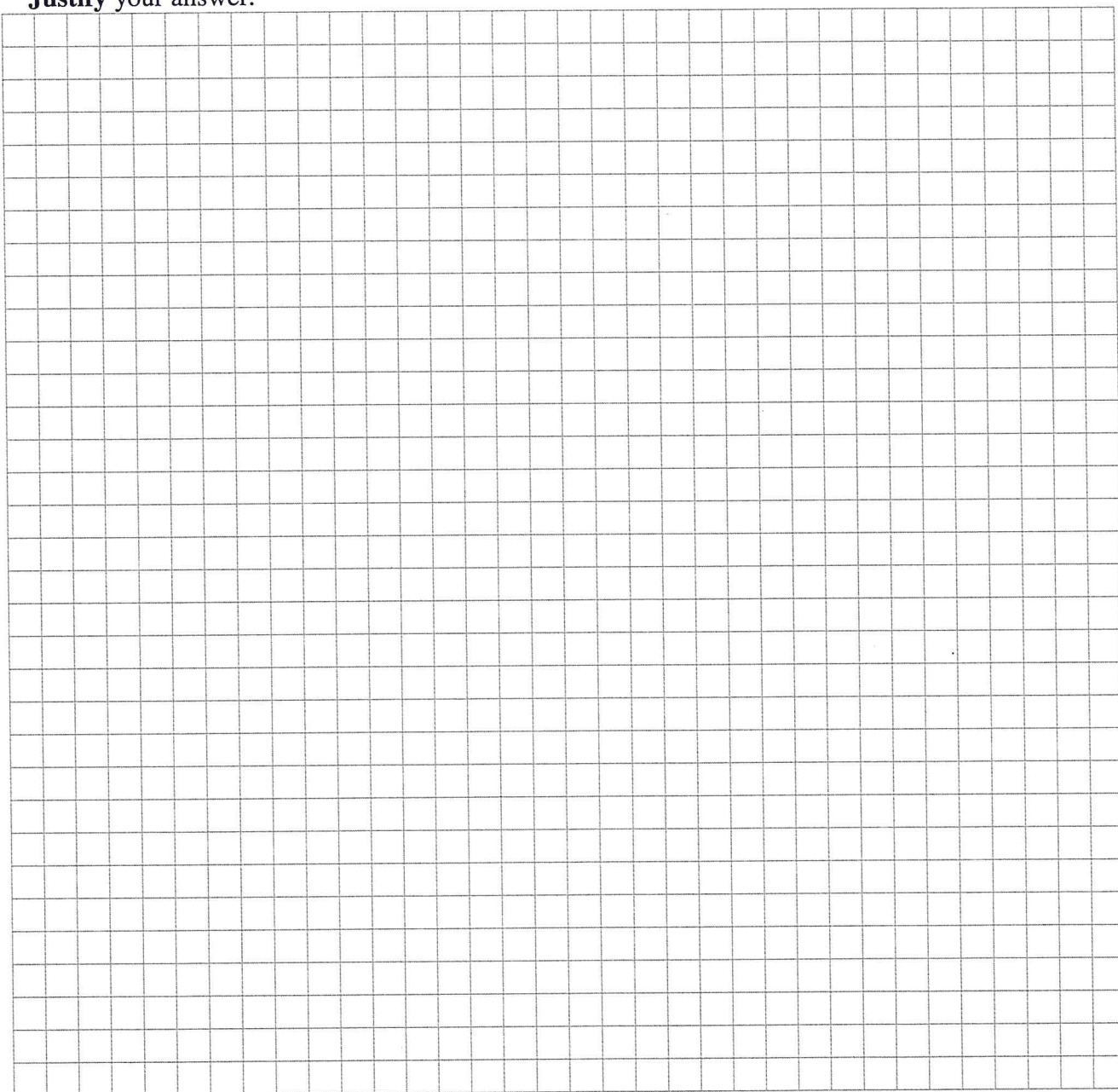
- C3)** **Determine** the zeros of the quadratic relation with equation  $y = -2x^2 - 16x - 24$ .

C4) The table below shows data for average time on Facebook by age

Age	Average number of minutes per day on Facebook
13	54
14	96
15	126
16	144
17	150
18	144

- a) **Determine** an equation which could be used to predict Facebook usage for other ages.  
b) Could this model be used to predict average Facebook use for all Facebook users?

**Justify** your answer.





- C5) Quadratic relations may have 2, 1 or 0 zeros.  
Using a variety of forms of equations and representations, write examples of each case and **justify** your choices.

A large grid of graph paper, consisting of 30 columns and 30 rows of small squares, intended for the student to write their examples and justifications.

